BY ORDER OF THE COMMANDER
AIR FORCE MATERIEL COMMAND

AFMC HANDBOOK 44-1
31 July 1995

Medical

FOCUS ON FITNESS

AFMC FITNESS RESOURCE MANUAL

AFMC FITNESS PROGRAM

AFMC PHILOSOPHY

"Our goal is to motivate life-style changes which will encourage all individuals to work at a personal conditioning program throughout and beyond their Air Force career"

(Gen Ronald W. Yates, AFMC Commander 1992-1995.)

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OVERVIEW

1. This handbook is for the individual who is just beginning a fitness program, the elite warrior, the flyer, the Olympian-hopeful, and all those who fall somewhere in between.

2. **What makes this handbook special?** What makes this handbook special is that it takes information from the experts in exercise physiology, biomechanics, kinesiology (the study of the body in motion), as well as from those individuals who have experience in Wellness programs, sports medicine, and special operations. As you can see, this handbook covers the basics from A to Z. The emphasis will be on the "Basics", which when neglected lead to poor results, frustration, and/or injury.

3. How can I benefit from using this handbook? By learning the "Basics" you will learn how to prevent injuries, how to scientifically train to get the most from your hard effort, and learn the good feeling associated with being fit without pain.

4. To quote Robert Shelton, Professor Emeritus, University of Illinois, in his text entitled "Basic Exercise"

"Too often, the movements prescribed as exercise are not basically sound with no underlying scientific principles. The prescription of exercise should be as exact in its application as that of medication prescribed by the physician."

5. The goal of the AFMC Fitness Resource Handbook is to educate you in the art and science of proper exercise. The science will give you the "Why?"; the art must come from you. You must learn how to apply the basics while listening to your body. Your body will definitely speak to you and let you know how you are doing. The trick is to learn how to listen so that when it speaks, you act properly on its message.

6. With that said, it's time to begin the study in the art and science of proper exercise.

your EXERCISE PROGRAM

1. Your exercise program should consist of three fundamentals:

a. **Warm-up.** This can be separated into two phases. Phase 1 is where you are actually creating warmth in the muscles to permit them to operate more efficiently (very similar to letting your car warm up on a cold morning). Phase 2 consists of muscle lengthening to permit a person to go through a full range of motion (commonly known as stretching). Your warm-up session should last only 5-10 minutes.

b. **Training the body's proper energy system.** In this handbook we will emphasize training the aerobic system. The aerobic phase of exercise utilizes fat (in the presence of oxygen) as its main energy source after 20-60 minutes of continuous exercise, using the same large muscle groups in a rhythmic fashion (e.g., walking, running, swimming, biking, rowing, skiing, etc.). Depending on your level of physical conditioning, you might be starting out at 5 minutes, or you may already be up to 20-60 minutes of continuous exercise, 3 to 5 times per week, and within your target heart rate zone.

c. **Cool-down (sometimes referred to as warm-down).** This is **IMPORTANT!** You could literally die if you forget this one. When you stop exercising, your heart (a muscular pump) has to work very hard by itself to get the blood back to the heart and lungs to pick up more oxygen. If you **cool down,** using light movement or walking, for about 5 minutes to a heart rate below 120 beats per minute, your muscles will act as a **second pump**. This second pump massages blood back through one way valves in the veins assisting the heart's pumping action. As a result, the heart doesn't receive that sudden strain which could endanger your life.

2. The following pages will guide you in your quest for fitness.

the WARM-UP

1. Your warm-up should consist of two phases lasting approximately a total of five minutes. The first phase *general warm-up* should consist of two to three minutes of light movement, such as walking to **warm up** the muscles and cardiovascular system. You could also perform *related warm-up* exercises that resemble your activity, e.g, light peddling on a cycle before your bike ride. How intense should this phase be? Enough to break a light sweat.

WARNING! Sudden, vigorous exercise can be potentially dangerous to your heart. Also, you are more susceptible to muscular/skeletal injuries.

2. The second phase consists of gaining full range of motion for those specific joints of the body that are involved in your activity. This is commonly referred to as stretching. One method of stretching is *active control stretch*. The explanation of how it works is far more difficult to express in writing than it is to put into practice. However, it is scientifically sound. In easy-to-understand terms, *active control stretch* is performed by moving a body part through a range of motion. During this movement, one set of muscles contract while the opposing muscles relax. For example, when an individual performs a biceps curl, the biceps contract and the triceps relax. Thus, the triceps are "lengthened." I will refer to the desired outcome as the muscle is *lengthened* as opposed to *stretched.*

NOTE! When you move your limbs through a range of motion to lengthen the muscle, you do not want to feel severe stretching or pain in that muscle. If you feel strain or pain, you are, in fact, throwing in the stretch reflex which causes that muscle to contract. Therefore, you are defeating your goal of lengthening that muscle.

3. Although there are many applications of *active control stretch*, we will focus on only a few basic exercises to increase the muscular balance in the most commonly ignored muscle groups. Diagrams are provided for easy use.

4. The main areas targeted are:

   a. Achilles Tendon Area (Calf muscle also called Gastrocnemius and Soleus Muscles)

   b. Hamstring Muscles (Back of thighs)

   c. Illio psoas Muscles (Hip flexors)

   d. Erector Spinae Muscles (Back muscles)

NOTE! These targeted areas are emphasized because they are the site of many injuries and problems.

SCIENTIFIC STRETCHING using ACTIVE CONTROL STRETCH

1. Active Control Stretch (ACS) was a method developed by Robert Shelton, Professor Emeritus, University of Illinois for the purposes of pre-conditioning, reconditioning, and rehabilitation of the human body. In his handbook, "Basic Exercise," he describes ACS:

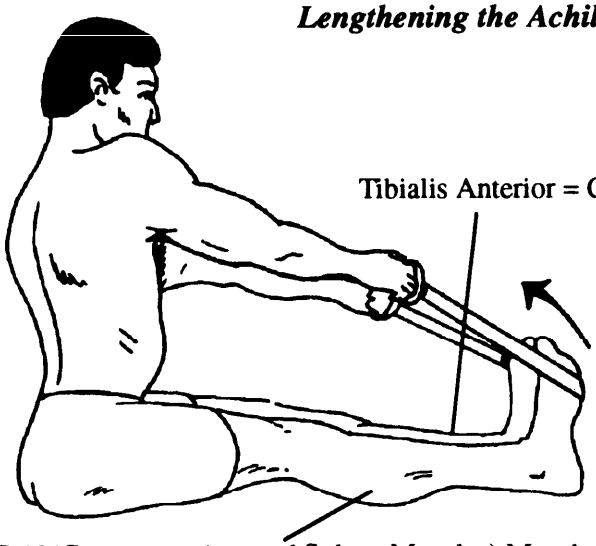
a. Active Control Stretching (ACS): With the control method, the position of exercise is emphasized. The muscle to be stretched is placed in a position opposite that of gravity. In this position, the tight muscle is antagonistic to the moving muscle. As long as the moving muscle is contracting, the antagonist is inhibited from contracting and, therefore, relaxes. As the moving muscle is progressively strengthened, its ability to stretch the tight antagonist muscle is heightened. In situations where the moving muscle (anonist) has insufficient strength to stretch the antagonist (tight muscle), a handbook stretch method is applied. The handbook method is the same as the control method as to position and performance except when the terminal extensibility of the right muscle is reached, then an external force is applied. This force is applied up to the point of myotatic reflex (act of motor stimulation of tight muscle) (the stretch reflex--author's note).

b. All exercises are performed throughout the full range of motion of the skeletal structure to ensure maximum strength, flexibility, and range of joint motion.

2. The Achilles Tendon, Gastrocnemius, and Soleus Muscles (Calf muscle-see drawings)

While sitting on a flat surface with leg extended, flex your foot toward your body to near maximal range of motion, relax, letting your foot return to your starting position. Perform at least 10 repetitions with each foot.

Lengthening the Achilles Tendon area



Perform 8-10 Repetitions - you can assist the movement of the foot with a belt; however, no pain or strain.

3. The Hamstring Muscles (back of thighs)

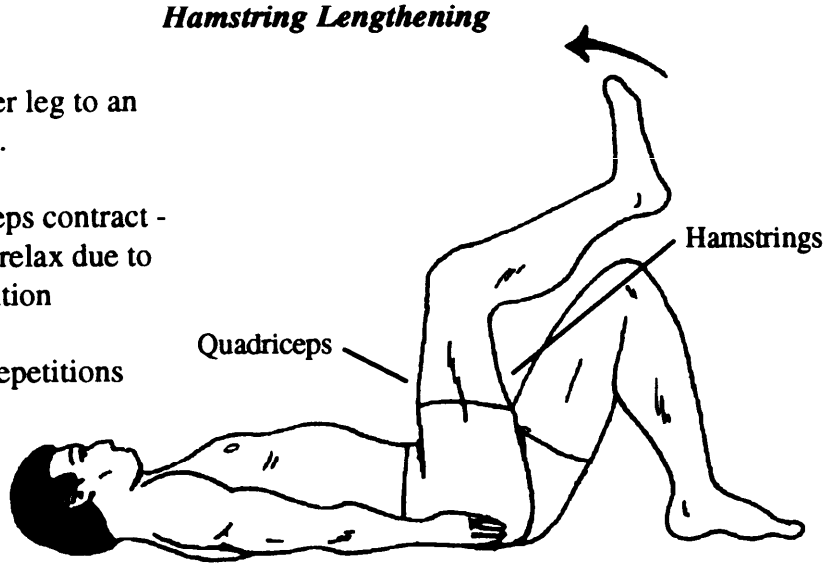
Lie on your back and *slowly* raise the lower leg to the upright position, relax, and lower the leg to the starting position. You must not feel extreme tension or pain in the hamstring muscle. Doing so would activate the *stretch reflex* defeating the muscle lengthening process. Perform at least 10 repetitions with each leg.

Hamstring Lengthening

Extend the lower leg to an upright position.

As the Quadriceps contract - the Hamstrings relax due to reciprocal inhibition

Perform 8-10 Repetitions



NOTE: You should not feel pain or strain in the hamstrings. If you do, you will throw in the stretch reflex - causing the muscle to contract.

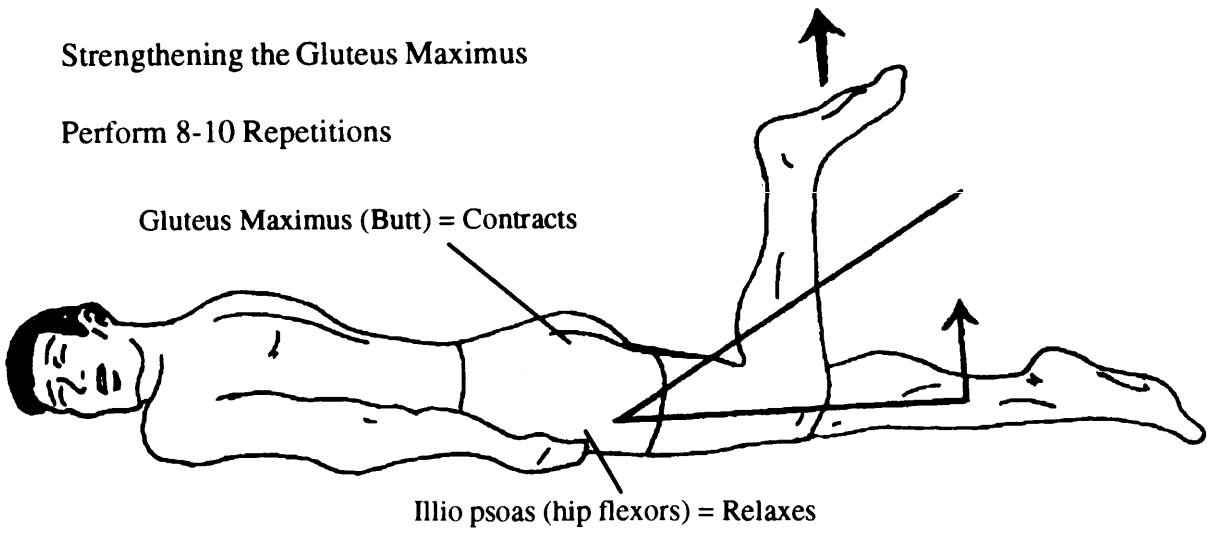
4. The Illio psoas Muscles (hip flexors)

This may be difficult for individuals with low back problems. Lie on your stomach and raise your leg *straight* up (contracting your gluteus maximus--buttocks) while the leg is bent at the knee, relax, and lower leg to the starting position. Perform at least 10 repetitions with each leg.

Lengthening the Illio psoas

Strengthening the Gluteus Maximus

Perform 8-10 Repetitions



5. The Erector Spinae (Back) Muscles

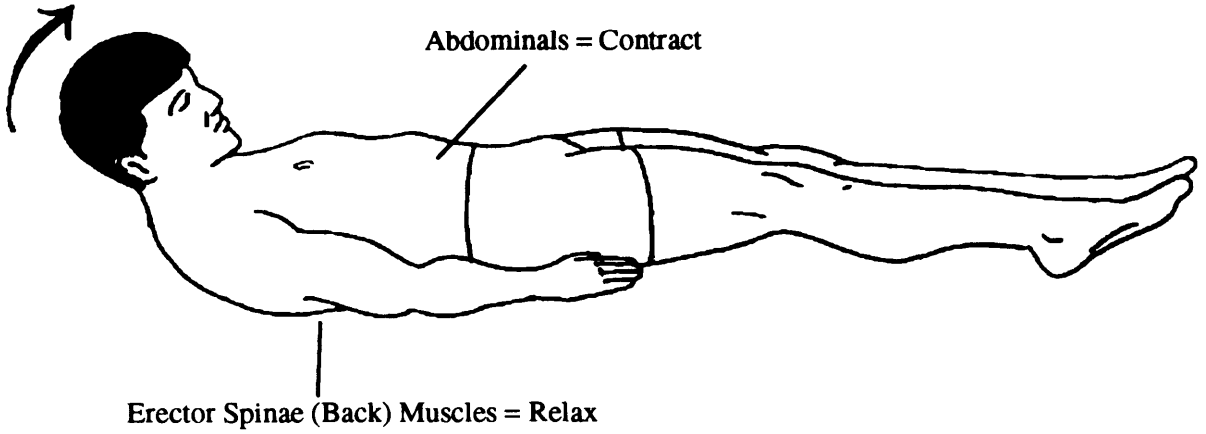
Opposite to your back muscles are the abdominal (stomach) muscles. Therefore, slowly curl your body inward starting with tucking your chin in and continuing to curl your body inward. When you have curled up to the sit-up position or if you feel tension in your back, relax, and lower yourself to the starting position. Perform at least 10 repetitions. Note that you are not trying to perform 1000 sit-ups in 2 minutes. This is a slow and deliberate movement.

NOTE! All exercises are performed in a slow, deliberate manner. There should be no pain associated with this form of stretching. Ballistic type movements can cause injury and are contrary to Active Control Stretching.

Strengthening The Abdominals

Lengthening the Erector Spinae Muscles

Perform 10-12 Slow Repetitions



training your body's ENERGY SYSTEM

Your body has three energy systems that are called upon during exercise. The type of energy system that is activated depends largely on the type of exercise you are performing. A brief description is given below.

a. The Adenosine Tri Phosphate-Phosphocreatine system (ATP-CP) (anaerobic) is the highest intensity and quickest acting energy source. It is stored in the muscles and lasts for only about five seconds. Example: Lifting the heaviest weight that you can one time. Notice that you can't lift it again until you've rested for some time.

b. The Lactic Acid system (anaerobic) lasts only a few minutes and is also high intensity in nature. Example: Running as hard as you can around a 1/4 mile track. By the time you reach the end, your muscles ache and your legs feel like someone filled them with lead. Try as hard as you wanted, your lungs seemed to be failing you. You cannot get the oxygen to the crying muscles.

c. Aerobic system. This is the energy system we will concentrate on training. It is also the system that the new Air Force Fitness Program tests using the cycle ergometer. The aerobic system utilizes fat as its main energy source in the presence of oxygen. It takes approximately 20-30 minutes of continuous, rhythmic movement using the same large muscle groups to tap into this system. For example: walking, jogging, running, swimming, bicycling, cross country skiing, etc.

the AEROBIC SYSTEM

1. **Aerobic system.** This is the energy system you must concentrate on training. It is also the system that the new Air Force Fitness Program tests using the cycle ergometer. We're emphasizing the development of the heart muscle, lungs, and the supporting blood delivery systems, not big biceps. The *aerobic system* utilizes *fat* as its main energy source *in the presence of oxygen.* It takes approximately 20-30 minutes of continuous, rhythmic movement using the same large muscle groups to tap into this system (e.g., walking, jogging, running, swimming, bicycling, cross country skiing, etc.). A common misconception is that all you need to do is 30 minutes of aerobic exercise 3 times per week. The American College of Sports Medicine says that 30 minutes of aerobic exercise performed 3 times per week is the **MINIMUM** that someone should do to maintain health. The Air Force wants more for you. Remember that the goal for AFMC is to encourage lifestyle changes that include regular aerobic exercise to improve one's health and level of fitness while he/she is in the Air Force and beyond.

Your aerobic system can be measured using direct measurements or indirect methods. A test using direct methods would include analysis of exhaled breathing gasses during increased work loads during exercise. This is a sophisticated test that takes some pretty sophisticated equipment as well. Indirect methods include the new Air Force fitness cycle ergometry test.

a. This test looks at a person's heart rate rise in response to given work loads. A person who has a lower heart rate for a given work load is considered in *better shape* than a person who has to work harder. The heart rate response is correlated with a predicted VO_2 *max.* VO_2 *max* is a measure of a person's *maximal oxygen uptake.* A person reaches this point when the body has reached its limit to utilize oxygen and fat as its main energy source. Efforts beyond this point will lead someone into the *anaerobic system* which is short lived, and the person "poops out."

b. Since the submaximal *cycle ergometry* test uses heart rate response to exercise, then it should be noted that anything a person does immediately before the test that alters the heart rate could alter the results of the test (e.g., an individual should not exercise prior to the test). Immediate prior exercise will result in increased heart rates and possibly lower scores. An athlete getting *psyched* for the test (allowing competitive emotions to increase heart rate) may also alter test results.

2. How do I train the Aerobic system to get/stay healthy?

training the body's AEROBIC energy system

"I exercise all the time and still don't improve when I take my cycle ergometry test. Why not?!!!" How many times have you heard this question? This person is crying out for help. In today's media, we are bombarded with all sorts of advertisements that tell us we can get in shape by using this or that piece of exercise equipment "for just $19.95." "Yes, you too will be able to leap tall buildings in a single bound if you buy this uniquely fabulous gizmo and use it for just 10 minutes every other day." Briefly, let's look at what works and what doesn't.

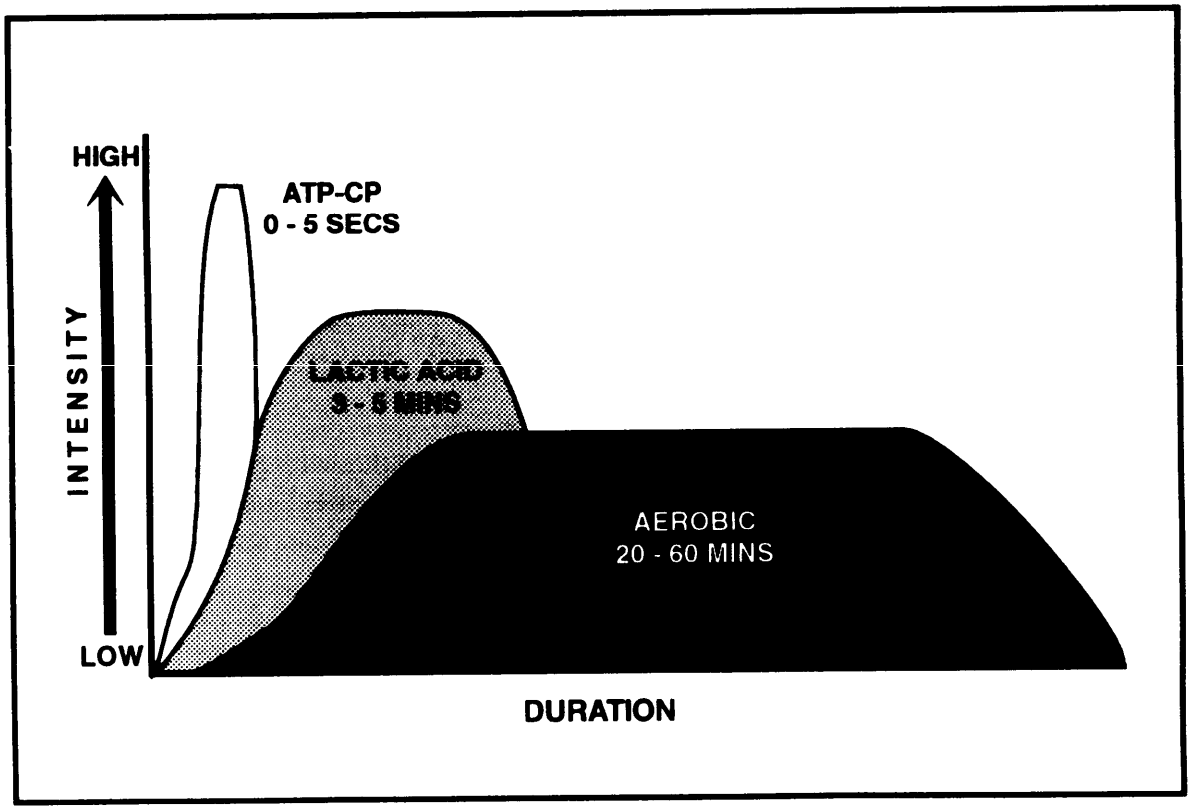
Anaerobic system (a combination of the ATP-CP and Lactic Acid systems). If you've ever run a 440-yard dash, you know this system all too well. Remember how you felt the last time you took off sprinting and your legs felt like lead weights? Try as hard as you wanted, your legs and lungs seemed to be failing you. You could not get the oxygen to the crying muscles. This is basically what happened. You burned up all the quick available sugar, and you no longer had any energy resource to draw from. As a result, your body slowed to a snail's pace to recuperate. Your body entered the anaerobic system. This system will supply energy for only a few minutes before it is depleted. It uses carbohydrates as its main energy source in the absence of oxygen (e.g., lifting weights, sprinting, etc.). No wonder all that weight training didn't help you much toward your Aerobic goal. You were training the wrong energy system!

THE FUEL THAT FEEDS THE ENGINE OR ... "WHY DO I GET SO EXHAUSTED DURING EXERCISE?"

You may be wondering what else you can do to improve your cycle ergometry fitness level. Believe it or not, the food you eat or don't eat does make a difference. Whether you fatigue easily or don't is determined not only by the type of training but by the food you eat.

Your capacity to work, run, swim, or cycle is dependent upon your ability to transfer energy from the food you eat to your muscles. Energy is supplied to the muscle in three ways: by the stored phosphagen system (adenosine triphosphate-creatine phosphate or ATP-CP system), the lactic acid system, and the aerobic system.

An individual does not solely rely on one energy system. In reality, the body blends all three energy systems to do its work. This is called the energy continuum (see diagram).



Once you understand these three energy systems, you can learn to train and eat for best performance. If you're interested in improving your level of aerobic fitness or boosting your cycle ergometry score, you can easily see why weight lifting alone does not work. Short, intense exercises utilize the ATP-CP and Lactic Acid systems (both Anaerobic in nature). It really takes about 20 to 60 minutes of aerobic activity to see benefits in your cycle ergometry test score.

OK! NOW THAT I KNOW THE THREE ENERGY SYSTEMS, DON'T THEY ALL USE THE SAME ENERGY SOURCE?

Said another way, ". . . does the type of food that I eat make a difference in my performance?" The answer is yes!

Different types of food power the different energy systems. The ATP-CP and Lactic Acid (anaerobic) systems rely mainly on carbohydrates stored in the muscles as their primary source of fuel. The Aerobic system uses carbohydrates in the blood first then predominately uses the breakdown of fat later in exercise. If you eat meals consisting mostly of protein (poultry, fish, beef, eggs, etc.), then your body is starving for quick fuel to complete strenuous tasks. High fat diets are inefficient because of the difficult process required to break down fat to convert it into energy. A proper proportion of the three basic food types best prepare you for hard work or exercise. If you don't eat a balanced diet, your energy reserves may be low which could affect not only your physical status, but also your mental ability and emotional well-being.

Your diet should consist of about 50-60% complex carbohydrates (pasta, potatoes, whole grain cereals and breads, etc.), 12-20% protein (poultry, fish, lean beef, eggs, dried beans and peas, etc.), and 25-30% of fat (vegetable sources like corn or canola oil, tub margarines, etc.). Limit your intake of whole milk dairy products, meat fat, fried foods, gravies, rich desserts, etc. Another suggestion, eat three meals a day and distribute your calories throughout the day. Don't skip meals or load up at dinner time when your activity level slows down. What should your daily calorie intake be? For a moderately active individual, it should be approximately 12 to 14 times your normal weight. If you weigh 150 pounds, then 150 X 12 = 1,800 calories per day for normal functioning. Endurance athletes can consume several thousand calories per day while still maintaining their ideal weight. Why? Because their energy input roughly equates to their energy output. That is, they "burn off" those extra calories they consumed as they exercise.

There you have it. Just like Mom would tell you--eat a balanced diet with plenty of vegetables, fruits, and grains. Watch out for too much fat, particularly hidden in processed, packaged, or fast foods. Remember, your performance during exercise and on the cycle ergometer test relies not only on your training, but what you eat. The fuel that powers the engine.

using your HEART RATE as a guide to AEROBIC FITNESS TRAINING

Your heart rate can be used as a guide to tell you if you are working at the appropriate aerobic intensity level. You will achieve the greatest success by figuring out your training target heart rate and exercising at that level.

Among the many methods used to calculate training target heart rate, this is one of the quickest and simplest. Your approximate training target heart rate can be figured out using the following formula:

1. Calculate your Maximum Heart Rate.

   Maximum Heart Rate (MHR) = 220 - your age

   i.e., if you are 40 years of age then . . .

   220 - 40 = 180 (your MHR)

2. Calculate your training Target Heart Rate (THR).

   Multiply your MHR by your desired workout intensity range (i.e., 65% and 85%)

   180 X 65% = 117 beats per minute (your minimum training target heart rate)

   180 X 85% = 153 beats per minute (your maximum training target heart rate)

3. Therefore, your approximate training target heart rate is between 117 and 153 beats per minute.

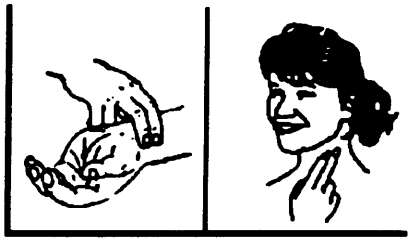
NOTE: Elite (aerobically) conditioned athletes can add 15% to their maximum training target heart rate number for greater accuracy.

The better condition you are in, the closer to your maximum training target heart rate you can work. When individuals can achieve a work load of 90% of their maximum heart rate, then they are working at approximately 85% of their VO_2 Max. Working above this level of exercise will not bring any appreciable gains for the average person. Training at heart rates between 60-70% are for low-to-moderate training levels. Seventy to 80% heart rates are considered moderate, and 90% and above are considered high-intensity training levels. See charts 1 and 2 for an easy guide to determine your exercise training heart rate. The key is to build yourself up gradually then stick with your program for life.

NOTE: An advanced formula for calculating your target heart rate is found in Appendix B.

EXERCISE TRAINING HEART RATE

CHART 1



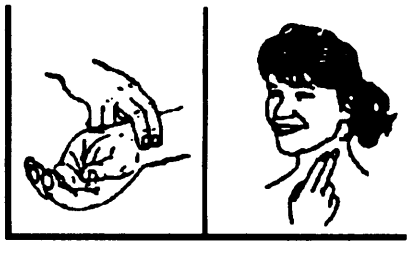
DIRECTIONS: During exercise, check your heart rate by taking your pulse at your wrist or neck for 10 seconds.

- Place your first two fingers lightly over the radial artery on your wrist or the carotid artery at the side of your neck next to your throat. Do not press hard at your neck or you may slow your heart rate down.
- Count the number of beats that occur in 10 seconds.
- Choose your target heart rate (THR) zone based on your current level of fitness (65% if you are a beginning exerciser, 75% if you are a regular exerciser, and 85% if you are in peak condition).
- Compare your 10 second pulse against your desired exercise intensity level for your age group in the chart. If you're below your target heart rate zone, push a little harder. If you're above, slow down and take it easy
- Your ultimate goal is to work at 85% level for the majority of your exercise period. **REMEMBER**, if you feel unduly overexerting yourself, decrease your intensity immediately.

EXERCISE INTENSITY

AGE	65% Max HR	75% Max HR	85% Max HR
20	22	25	28
25	21	24	28
30	21	24	27
35	20	23	26
40	20	23	26
45	19	22	25
50	18	21	24
55	18	21	23
60	17	20	23
65	17	19	22

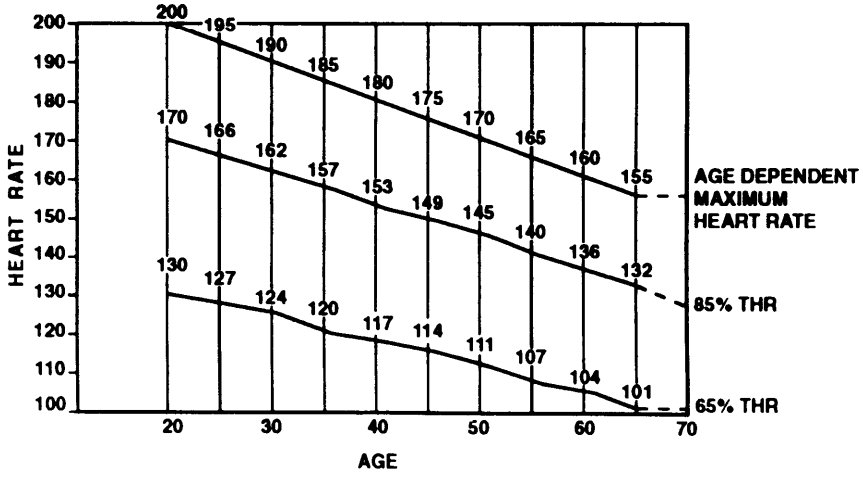
CHART 2



DIRECTIONS: During exercise, check your heart rate by taking your pulse at your wrist or neck for 10 seconds.

- Place your first two fingers lightly over the radial artery on your wrist or the carotid artery at the side of your neck next to your throat. Do not press hard at your neck or you may slow your heart rate down.
- Count the number of beats that occur in 10 seconds. Multiply this number by 6 to get your heart rate per minute.
- Choose your target heart rate (THR) zone based on your current level of fitness (65% if you are a beginning exerciser, 75% if you are a regular exerciser, and 85% if you are in peak condition).
- Compare your heart rate to your THR zone for your age.
- If you're below your THR zone, push a little harder. If you're above it, slow down and take it easy.

TARGET HEART RATE



using the RATING OF PERCEIVED EXERTION (RPE) SCALE to gauge workout levels

"Does my perception of work effort correlate with my heart rate and VO_2 Max?" Yes. As you exercise aerobically, take your heart rate and compare it to how hard you feel you are working. Another way to put it is *verify* that your perception of exertion matches your target heart rate (THR). Research has shown that for a 20-year-old, the correlation would resemble the chart below. Adding a zero (0) to the listed number on the chart will approximate the 20-year-old's heart rate for a given perception of exertion. You can make a similar chart for yourself using your calculated maximum heart rate (220-your age) as the greatest number. You should exercise between 12-16 on the Borg scale, which roughly correlates with your target heart rate range.

RATING OF PERCEIVED EXERTION

Category	RPE Scale
6 (0)	
7 (0)	Very, very light
8 (0)	
9 (0)	Very light
10 (0)	
11 (0)	Fairly light
12 (0)	
13 (0)	Somewhat hard
14 (0)	
15 (0)	Hard
16 (0)	
17 (0)	Very hard
18 (0)	
19 (0)	Very, very hard
20 (0)	

(From Borg GA: Med Sci Sports Exerc 14:377-387, 1982)

The Use of HEART RATE MONITORS

High tech fitness is here! As Air Force Materiel Command surges ahead with the fitness program, we will move into the 21st century using high technology to support our GET FIT and FITE programs. AFMC uses high tech heart rate monitors to lead the way to a fitter and healthier force.

Many top endurance athletes utilize heart rate monitors to gauge their workouts. Some monitors can give you extremely accurate information (within one heart beat per minute). Lance Armstrong, the 21-year-old United States professional cycle champion, recently pulled out of the 11th stage of the Tour de France bicycle race because his morning blood pressure was off and his pulse was higher than normal according to Samuel Abt, "Bicycling Magazine," Oct 93. His coaches used his heart rate information to "gauge" the young cyclist's physical condition. Similarly, your heart rate provides useful information that can be used to monitor your overall health, provide instant feedback on workout intensity, and detect overtraining, etc.

Your heart rate is similar to the speedometer in a car. It informs you how fast the internal motor (your heart) is working. The heart rate for a particular work load indicates the level of physical condition. Generally, your heart rate lowers with training.

How you become fit is important. In the past, individuals used the "gut it out" method of training. Although some people appeared to have some success with this method, most who experienced this method paid a high price. Overtraining produces long -term injuries and periods of time when there just doesn't seem to be any progress in sight--people plateau! We know that aerobic training using the target heart rate method will produce the best results for the majority of personnel.

MONITORING YOUR HEART RATE

Some may ask, "Why can't you just take your own pulse? Isn't it cheaper?" Sometimes cheaper is not necessarily better. One of the chief complaints when trying to measure your radial pulse is that your heart rate slows shortly after stopping exercise, thus giving false measurements. At the 1993 World Wide Health Promotions Conference, Dr. James M. Rippe, M.D., found in his study of individuals who took their heart rate using the radial pulse method that there was a 15% average error rate. Now there is no need to stop exercising to take your pulse and wind up with a false heart rate measurement. Using a heart rate monitor will provide you with a continuous heart rate reading that is graphically displayed in front of you constantly. The following diagram demonstrates a typical heart rate response to aerobic exercise.

TYPICAL HEART RATE RESPONSE TO AEROBIC EXERCISE

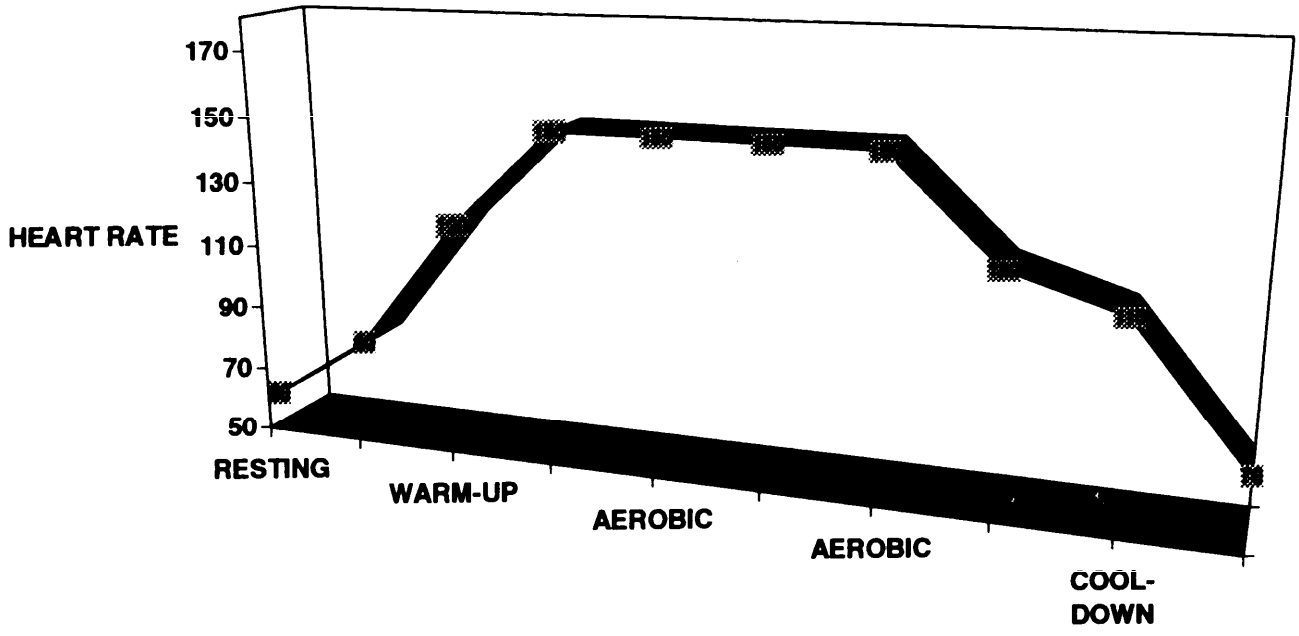


Chart 3 is a tool you can use to track your exercise heart rate during an exercise session. Chart 4 is a tool to track your your daily excercise heart rate.

CHART 3: TRACK YOUR EXERCISE HEART RATE DURING AN EXERCISE SESSION

- PLOT YOUR HEART RATE DURING A WORKOUT SESSION

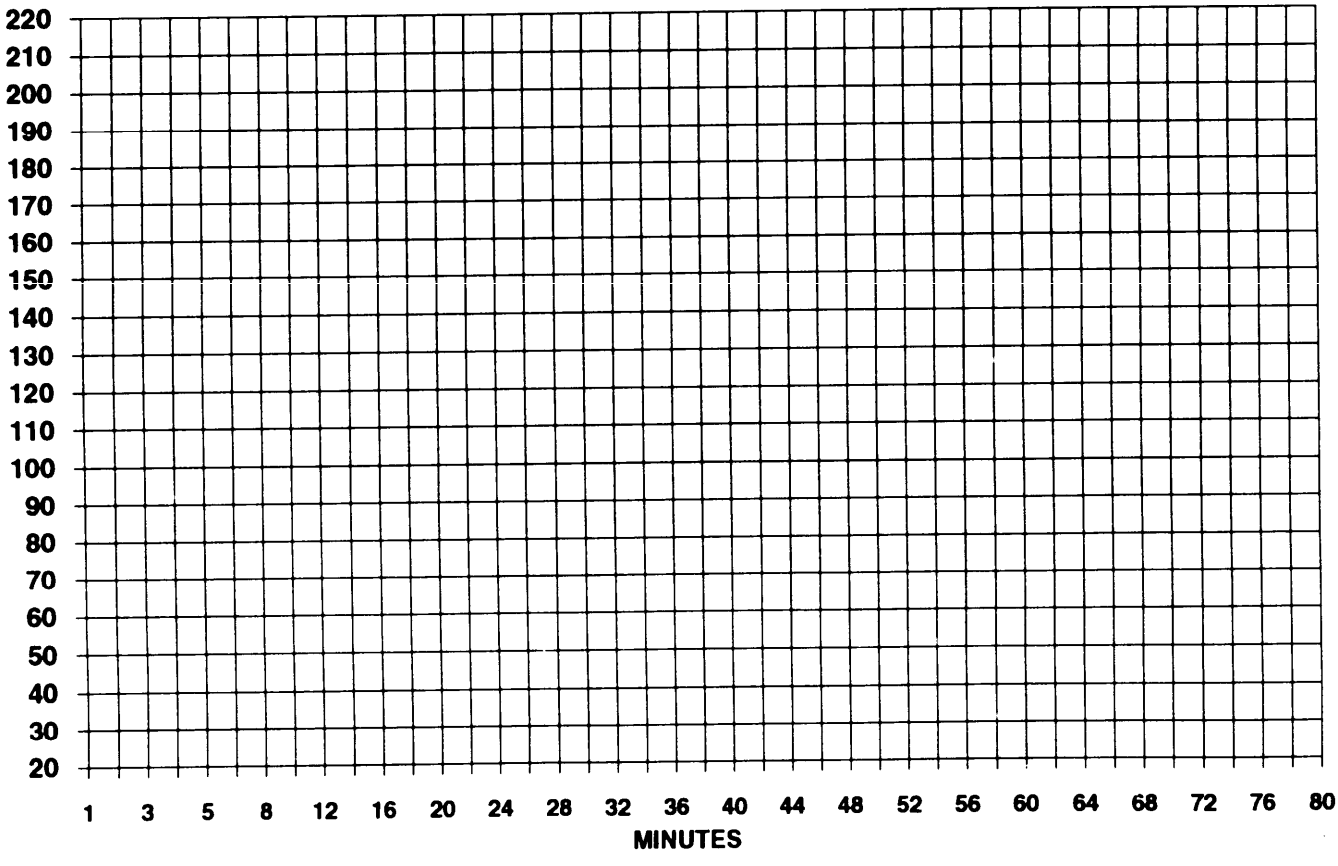


CHART 4: TRACK YOUR DAILY EXERCISE HEART RATE

- - USE A HEART RATE MONITOR (SOME MODELS WILL CALCULATE AVERAGE HEART RATES DURING EACH EXERCISE SESSION OR USE THE PULSE METHOD)

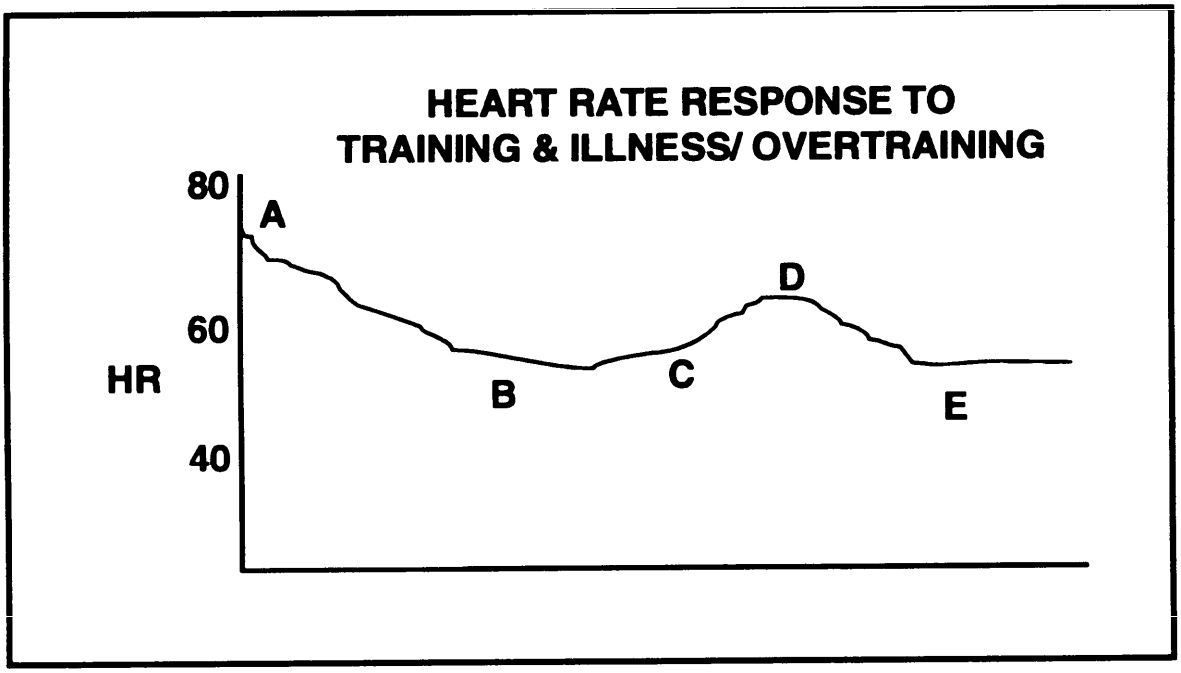
DAY	TYPE OF AEROBIC EXERCISE	AVERAGE HEART RATE	DURATION	DISTANCE "NICE TO KNOW"	WORKLOAD "NICE TO KNOW"
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

EXAMPLE	RUNNING	150	49 MINUTES	7 MILES	
	STATIONARY BIKE	145	60 MINUTES		150 WATTS OR 3 kp
	SKI MACHINE	135	55 MINUTES		LEVEL 3
	BIKE RIDE	135-140	120 MINUTES	30 MILES	
	SWIMMING	140	45 MINUTES	XX LAPS	
	ROWING	145	55 MINUTES		100 WATTS

what your RESTING HEART RATE tells you

If you take your pulse every morning and then plot it on a chart, you might see the following example as your aerobic training continues. You will notice that there is a general decrease in resting heart rate of 10-15 beats per minute. Once in condition, a rise in heart rate can be used as an indicator of future illness or overtraining. When this occurs, as in C and D, it's time to get some rest and back off of training. As you recuperate and return to your conditioning program, your resting heart rate will once again lower.

Chart 5 is a tool to track your resting heart rate.



A = BEFORE TRAINING

B = TRAINED

C = PRE-ILLNESS

D = ILLNESS OR OVERTRAINED

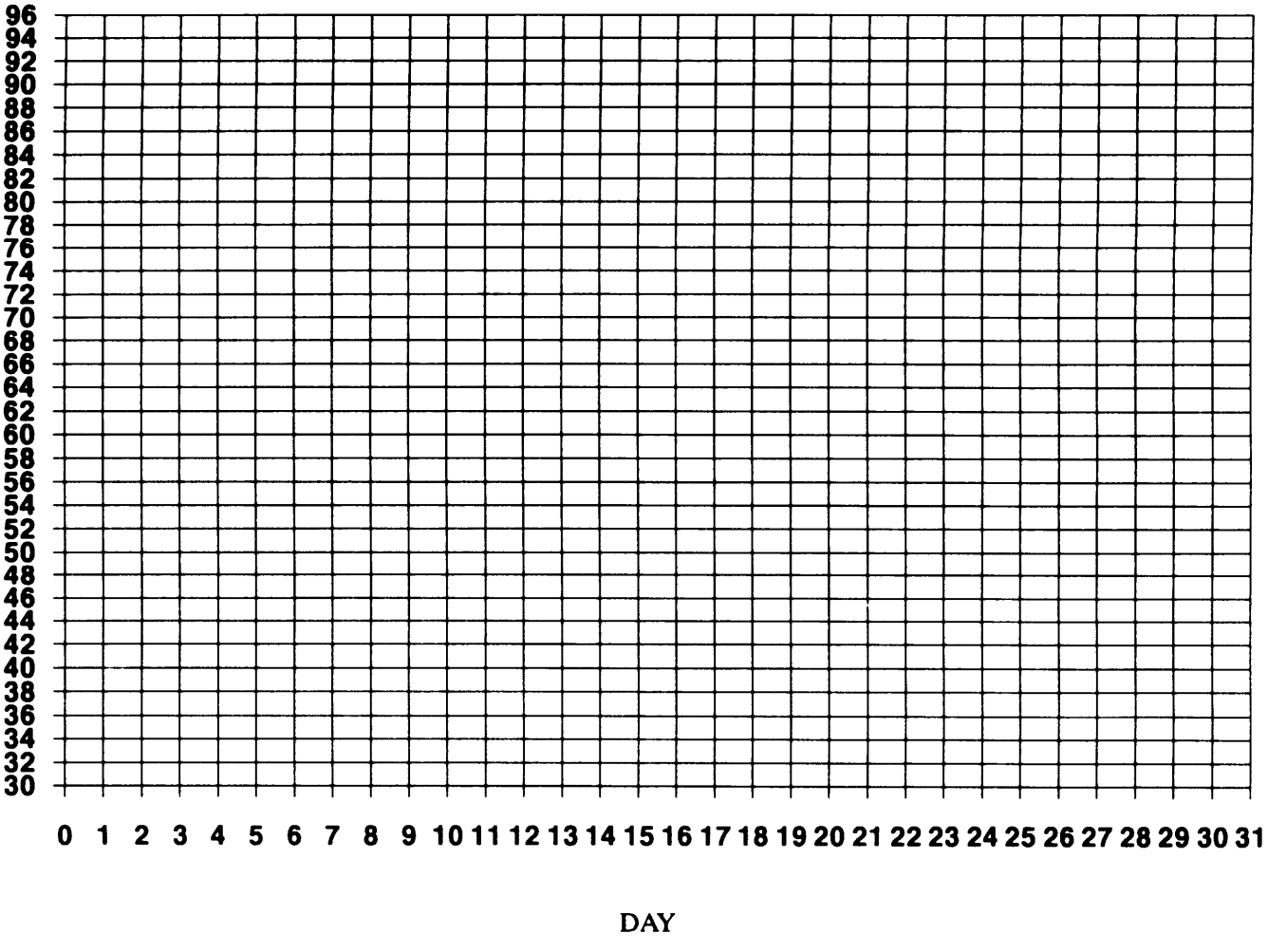
E = RECOVERY

CHART 5: TRACKING YOUR RESTING HEART RATE

- PLOT YOUR RESTING HEART RATE BY DAY OF THE MONTH

- TRACK TRENDS WITH CONDITIONING PROGRAMS, ILLNESS, OVERTRAINING, ETC.

- USE TRENDS TO FINE TUNE YOUR EXERCISE PROGRAM



the TRAINING EFFECT

"OK, OK! I've been working out for a month now, and I'm not Category IV yet! It can't be me; it must be a problem with either the cycle ergometry test or the GET FIT Program!!!" Don't you believe it. You need to get educated on what is happening to your body while you exercise and how long it's going to take you to improve.

"What is happening to my body when I exercise?" There are two answers to this question. One looks at what happens to your body ***during*** exercise and the other looks at how your body ***adapts*** to exercise. ***During*** aerobic exercise, your lungs must take in greater amounts of oxygen (the good air) which is transported to the working muscles by your red blood cells. To pump your blood, your heart muscle contracts rhythmically and forcibly moving blood to the working tissues. The greater the work load, the harder or more efficiently the heart has to work to pump that blood to the tissues, so that the oxygen can be utilized. The working muscle then combines food plus oxygen and creates energy for the working muscle. Without oxygen or food, the body cannot exercise. It's as simple as that! As the blood returns to the lungs, carbon dioxide (the bad air) is expelled and oxygen (the good air) enters once again with your next breath.

Now, why does an individual perform poorly on the cycle ergometry test? If your heart and blood vessels are poorly conditioned when you try to pedal the cycle ergometer, your body reacts by increasing the rate of your heart beat to increase the blood flow. Remember, without food and oxygen carried by your bloodstream, your muscles cannot work. So when your heart rate increases to meet the demand on your muscles, your test results are justifiably poor. If your heart is conditioned, then your heart rate will still increase but at a slower rate. "How does my heart pump more blood to the working tissue than if I'm in shape?" A well-conditioned heart will contract more forcibly and efficiently with each beat than an unconditioned heart. The better condition you are in, the greater resistance you can handle with associated lower heart rates.

"So back to the original question. I've been working out a month now, and I'm still not at a Category IV level. What does a person have to do!!!" Remember, I said there are two answers to your question on what's happening to your body during aerobic exercise. You've begun exercising properly. That's the ***first big step*** toward success. The other important part of the answer can be summed up with the word ***"adaptation."*** The purpose of aerobic exercise is to increase the maximum amount of oxygen your body can process within a given amount of time. When you exercise aerobically, you actually condition your body (heart, lungs, muscles, nervous system, etc.) to use oxygen more efficiently. Your body *adapts or changes biochemically and structurally* during rest. After months and years of aerobic exercise your body benefits by becoming more efficient. Your heart muscle becomes stronger, more efficient. How can you tell this? Each morning take your Resting Heart Rate (RHR) for one minute. Your RHR will decrease over time with aerobic exercise.

"What conditions prevent me from improving?" First, let me dispel a major rumor. Have you heard anyone say "But I have a naturally high heart rate! I'll never do well on the test!" Not true! If you do not have an underlying medical condition, then what you are observing firsthand is an unconditioned body (heart, blood vessels, etc.). Your body is deteriorating from the inside out. The heart has to beat faster because it is not strong and efficient. As already stated, regular aerobic exercise can reverse this trend. So what can really stop you from improving? The most obvious answer is to continue to do nothing. Then your body will continue to deteriorate and you will become more susceptible to the diseases of inactivity and aging. The bottom line: if you're not putting effort into your exercise program, you are increasing your risk of serious illness and limiting your potential dramatically.

aerobic exercise + adaptation = success

CYCLE ERGOMETRY: HOW TO MAXIMIZE YOUR TEST SCORE

What can I do to make sure I pass this new physical fitness test?

First, you need to understand how the test works. By measuring how much your heart rate increases as a result of the work you perform on the cycle, we can get an estimate of how efficient your heart-lung-muscle machine is. Your score is a prediction of your aerobic capacity which gives the Air Force an indication of how well you will be able to perform continuous, sustained, strenuous work.

Because this test is heart-rate dependent, any condition that alters your normal heart rate can affect your test score. Elevated body temperature, exercise, eating, caffeine, tobacco, fatigue, room temperature above 80° F, talking during the test, etc. all have a direct stimulating effect on your body's metabolism. The residual effects may continue to effect metabolism for a considerable time. If your heart rate is still elevated when you take the test, your results may be skewed. Failure to comply with all aspects of the test protocol can result in misclassifications greater than 15%.

The most important criteria to achieve the best score possible is to participate in a continuous aerobic conditioning program at least 3 times a week for 20-60 minutes at a moderate intensity (60-80% of your maximum heart rate). Some individuals may require greater frequency, duration, or intensity of exercise to achieve Category IV. In addition, follow the preparatory guidelines provided by your unit fitness monitor:

- Arrive early for the test--give yourself time to relax before the test begins

- Wear loose, comfortable shorts so the test administrator can adjust your seat height properly (knee should be straight when your heel is on the pedal at the lowest position)

- Wear clothing that will allow you to expose your midriff to fasten an elastic electrode belt around your lower chest

- Do not exercise strenuously for ***at least*** 10 hours before you test

- Try to get a good night's sleep

- Do not eat a heavy meal within 4 hours or fast for more than 12 hours

- Do not drink any caffeinated beverages (coffee, tea, Coke, cocoa, etc.) within 4 hours

- Do not drink any alcoholic beverages within ***at least*** 12 hours

- Do not smoke or chew tobacco within 4 hours

- No blood donation or equal blood loss from injury in 72 hours

Remember, you're not trying to beat anything. You're merely doing a measured amount of work. Use your test results to gauge your level of fitness and challenge yourself to improve your performance. The results can be an incentive to maintain balance in your life with exercise, good eating habits, and emotional equilibrium.

APPENDIX B

ADVANCED FORMULA FOR DETERMINING EXERCISE TARGET HEART RATE

As your aerobic conditioning improves, so does the efficiency of your heart and lungs. So you may ask, "Doesn't that affect my target heart rate?" The answer is yes, it does. As your heart becomes more efficient, it doesn't have to beat as fast. Here is an advanced formula taking your resting heart rate into consideration.

Karvonen Formula:

Target Heart Rate (THR) = [(220 minus your age) minus your resting heart rate] multiplied by 0.65-0.85 and then add your resting heart rate

EXAMPLE: Using a 40 -year-old with a resting pulse rate of 50

THR = [(220-40) - 50] X .85 + 50
THR = [(180-50] X .85 + 50
THR = (130 X .85) + 50
THR = 111 + 50
THR = 161

If you would have used the basic formula to calculate your THR, it would have been the following:

THR = (220 - age) X .85
THR = (220 - 40) X .85
THR = 180 X .85
THR = 153

Therefore, this individual's 85% THR is more accurate at 161 heartbeats per minute for this individual. So why use the basic formula at all? It is an easily remembered formula and a great beginning point to learn how to exercise within your THR zone. However, if you want the more precise method, use the advanced formula.

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